INSTRUCTION MANUAL

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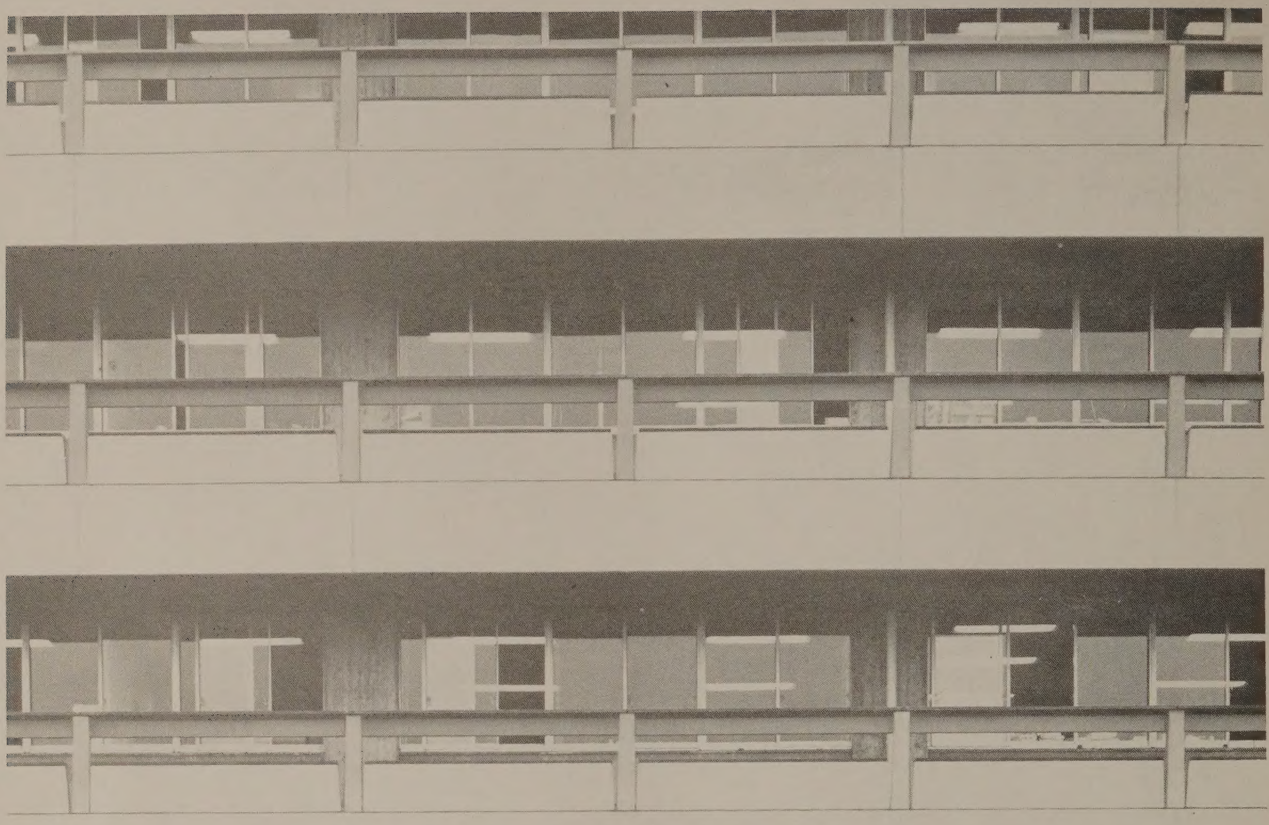
IWATSU

INSTRUCTION MANUAL

FUNCTION GENERATOR

SG-4101

A82-812101(L)



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Precautions

Ambient temperature and ventilation

The SG-4101 operates normally in the ambient temperature range of 0°C to +50°C. Be sure to use the SG-4101 within this range.

The accuracy is guaranteed in the range of +15°C to +35°C. Do not place anything near the ventilating holes in the cover not to prevent the heat dissipation.

Line voltage check

Before plugging the power cord to an electrical output, be sure to check its voltage. The SG-4101 can be used on the line voltage shown in Table 1 which can be selected with the voltage selector on the rear panel. Operating the SG-4101 on other than the specified voltage can result in breakdown.

Before changing the voltage selector, remove the power cord. Then, remove the fuse holder cap by turning it in the direction shown by an arrow. Pull and remove the voltage selector, then insert into desired center voltage value.

Table 1

Center voltage values	Voltage range	Fuse
AC 100V	90 to 110V	1A slow-blow
AC 120V	108 to 132V	
AC 220V	198 to 242V	
AC 240V	218 to 264V	

Be sure to replace the fuses with the correct ones.

The SG-4101 uses 1A slow-blow to protect the circuits from damage by over-current.

If the fuse is burnt out during the operation, carefully determine the cause, repair a defect if any, and replace it with the correct one.

Make sure not to use a fuse other than specified fused in order to avoid danger and trouble.

Do not short-circuit the output and ground

It may cause an excessive current and may damage the circuit.

Do not apply an input signal to output terminal

Do not apply an excessive input signal by accident. It may cause a damage to a part of the circuit.

When the power is switched on (Initial state)

When the power is switched on without setting FREQUENCE RANGE (Hz), a certain value is shown on the LED display to indicates that the circuit is in operation. The frequency as that time is not guaranteed.

When FREQUENCY RANGE (Hz) switch is pressed, decimal point (except for 100–1k and 100K–1M) and the unit (Hz or kHz) are displayed corresponding to the range.

When offset voltage is applied

When offset voltage is applied to an output signal, the maximum guaranteed valve is as follows.

Max. ±5V into 50Ω and 600Ω

Max. ±10V into an open circuit

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Section 1 Specifications

1-1 GENERAL

This FUNCTION GENERATOR SG-4101 is a small, light weight, highly-accurate and low-cost signal generator. It is provided with sine, triangle and square (symmetrical and asymmetrical) waveforms within the frequency range from 0.1 Hz to 1 MHz.

The large size and highly bright LED with character height 15 mm is used for the oscillating frequency display and it is easy to read.

The main characteristics are as follows:

- The oscillating frequency accuracy is different from that for the conventional dial method. High accuracy is obtained for all frequency ranges by the direct reading of LED indication.
- The oscillating frequency indication by 3½ digits and LED using a zero-blanking method.
- The oscillating frequency bandwidth can be continuously varied as wide as 0.1 Hz to 1 MHz.
- The signals can be provided at the same time at impedances of 50Ω and 600Ω loads.
- The duty ratio of square-wave is continuously variable from 50:50 symmetrical waveform to 85:15 asymmetrical waveform and it can be used as pulse generator.
- High-speed pulse with rise and fall time of 50 ns or less is obtained.
- High output voltage is obtained up to 20 Vp-p (into an open circuit)
- The synchronizing output signal canbe driven by TTL.

1-2 ELECTRICAL SPECIFICATIONS

Oscillating Frequency

Range:	0.1 Hz to 1 MHz in 7 steps.
	Continuously variable between FREQUENCY RANGEs
Frequency indication:	3½ digits LED display, Zero-blanking method.
	Indication of decimal point and unit (Hz, kHz)
Frequency accuracy:	±2% (+15°C to +35°C)

Output

Waveforms:	Sine
	Triangle
	Square (symmetry)
	Square (duty cycle 85:15 to 15:85) or DC
Voltage:	10 Vp-p or more into 50Ω and 600Ω
	20 Vp-p or more into an open circuit
Attenuator:	0 dB, 20 dB, 40 dB (only 50Ω OUT)
	Accuracy: ±5%
	Continuously variable between ATTENs.
Output impedance:	50Ω at 50Ω OUT
	600Ω at 600Ω OUT
Dynamic range:	±5V or more into 50Ω and 600Ω
	±10V or more into an open circuit
Offset:	±5V or more into 50Ω and 600Ω
	[Note] The output waveforms are guaranteed when the sum of a signal and offset is within max. ±5V.
	±10V or more into an open circuit
	[Note] The output waveforms are guaranteed when the sum of a signal and offset is within max. ±10V
Output voltage:	
Frequency characteristics:	On basis of 1 kHz, at 50Ω, 10 Vp-p output,
	Sine: ±3%
	Triangle: ±3%
	Square: ±3%

SYNC OUT

Waveform:	Square
Voltage:	+1V or more into 50Ω
	+2V or more into an open circuit
Output impedance:	50Ω

Output Waveform

Sine:

Distortion: At 50Ω and 600Ω, 10 Vp-p output,
±1% at 10–100–1K–10K ranges (+15°C to +35°C)
±2% at 10K–100K ranges (+15°C to +35°C)
[Note] No higher harmonics more than 30 dB are included 100K–1M range.

Triangle:

Linarity (10% to 90%): At 50Ω load, 10 Vp-p output,
±0.5% at 10–100–1K–10K ranges
±1% at 10–100K–1M ranges

Sqaure: At 50Ω load, 10 Vp-p output

Rise time: 50 nsec or less

Fall time: 50 nsec or less

Square wave characteristics: Over-shot: ±5%
Under-short: ±5%
Sag: ±5%

Duty cycle:

Fixed: At ⊓⊔ range 48:52 or more

Variable At ⊓⊔ range 15:85 to 85 : 15

[Note] Turning the DUTY control fully-counterclockwise or fully-clockwise, the variable duty waveform is not provided, only DC level is provided.

Stability

Frequency, output, offset: ±0.1%: Within 10 minutes
±0.5%: 24 hours

Power Supply

Power voltage

Center voltage	Voltage range
AC 100V	90 to 110V
AC 120V	108 to 132V
AC 220V	198 to 242V
AC 240V	216 to 264V

Selected by the voltage-selector.

Source frequency: 50 Hz to 400 Hz

Power consumption: 20W or less

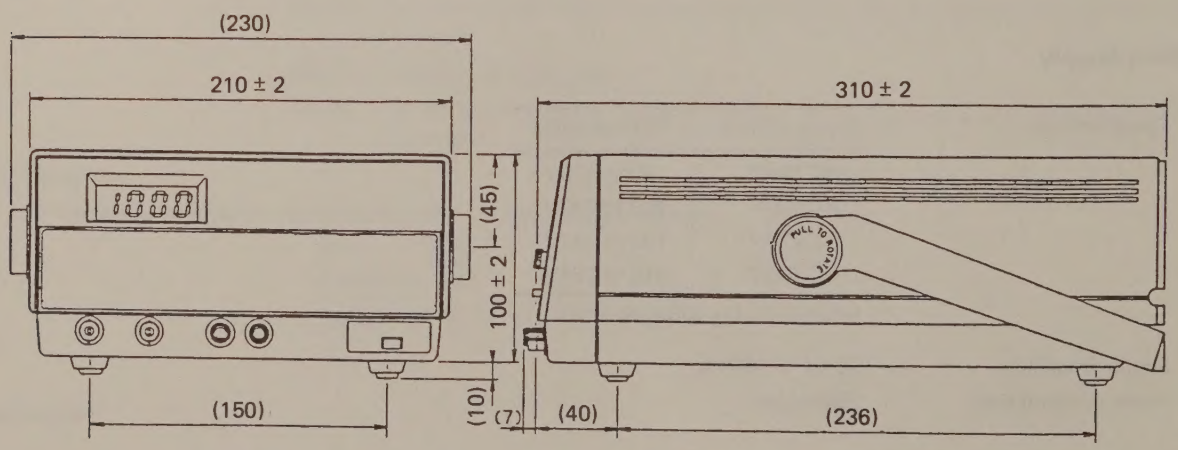
1-3 WEIGHT AND DIMENSIONS

Weight:	Approx. 2.6 kg
Dimensions:	(210 ± 2) W x (100 ± 2) H x (310 ± 2) L (mm) (See Fig. 1-3)

1-4 ENVIRONMENTAL CHARACTERISTICS

Operating temperature range:	0°C to +50°C
Operating humidity range:	40°C, 90% R.H.
Storage temperature range:	−20°C to +70°C
Storage humidity range:	70°C, 80% R.H.
Altitude:	Operating: 5,000 m Atmospheric pressure 405 mmHg Non-operating: 15,000 m Atmospheric pressure 90 mmHg
Vibration test:	Double amplitude of 0.63 mm, changing the frequency from 10Hz to 55Hz in 1 minute. For 15 minutes each in vertical, horizontal, and longitudinal directions for a total of 45 minutes.
Shock test:	One side of cabinet it lifted 10 cm (or 30° max. in elevation angle) and natural drop test onto a hard wood bench is repeated 3 times or more for each side.
Drop test:	Transportation-packed and dropped from a height of 90 cm above floor.

Figure 1-3 Dimensions



1-5 ACCESSORIES

Power cord	1
Fuse (1A slow-blow)	2
Accessories bag	1
Instruction manual	1

Memo

Section 2 Controls and Connectors

2–1 FRONT PANEL

①POWER ON-OFF

Turns instrument power on and off.

②600Ω OUT

Provides signal output with impedance 600Ω.

③GND

Singal ground terminal for measurement.

④50Ω OUT

Provides signal output with impedance 50Ω

⑤SYNC OUT

Provides SYNC OUTPUT signal.

Output voltages are as follow:

- +1V or more into 50Ω
- +2V or more into an open circuit

⑥FREQUENCY RANGE (Hz)

Selects oscillating frequency range of the signals.

The oscilating frequency is set by COARSE and FINE controls.

CAUTION

When the power switch is turned-on without setting FREQUENCY RANGE (Hz), only a certain number is shown on the LED display which indicates that the circuit is operating. Therefore, the frequency at that time is not guaranteed in such a case.

⑦COARSE

Coarse control to adjust the oscillating frequency.

⑧FINE

Fine control to adjust the oscillating frequency.

⑨FUNCTION

Selects output waveform.

∿ : sine

∧ : triangle

⊓ : fixed square (duty cycle 50:50)

⊓ : variable duty square (duty cycle 85:15 to 15 to 85) or DC voltage.

⑩DUTY

Controls the duty ratio of the square when (variable duty) is set.

Duty ratio is almost 50 : 50 at the midrange. When turned counterclockwise from midrange, the High level of the square becomes short and the Low level becomes long. The maximum duty ratio is 15 : 85. When turned fully-counterclockwise, only Low level (negative DC signal) is provided.

When turned clockwise from midrange, the High level of the square becomes long and the Low level becomes short. The maximum duty ratio is 85 : 15. When turned fully-clockwise, only High level (positive DC signal) is provided.

The oscillating frequency is not changed when varying DUTY control.

⑪ ATTEN (dB)

The attenuator used only for 50Ω OUT.

0: The attenuated value of the output waveforms becomes o dB (0).

20: The attenuated value of the output waveforms becomes 20 dB (1/10 times).

40: The attenuated value of the output waveforms becomes 40 dB (1/100 times).

⑫ AMPLITUDE

Controls the amplitude of the output waveforms. when turned fully-counterclockwise the amplitude becomes minimum, and when turned fully-clockwise, the amplitude becomes maximum.

When setting AMPLITUDE to fully-clockwise and ATTEN (dB) to 0, the amplitude of the output waveforms become as follow:

- 10 Vp-p or more into 50Ω and 600Ω
- 20 V or more into an open circuit

When turned fully-counterclockwise, each amplitude is attenuated more than 20 dB (1/10 times) from the above mentioned conditions.

⑬ OFFSET

Controls offset voltage. When the setting to midrange, the offset voltage is always OV.

- Into 50Ω and 600Ω.

Midrange	OV
Fully-clockwise turning	+5V or more
Fully-counterclockwise turning	−5V or more

- Into an open circuit

Midrange	0V
Fully-clockwise turning	+10V or more
Fully-counterclockwise turning	−10V or more

When the offset voltage is applied to the output signal waveform, the maximum guaranteed voltage is as follow:

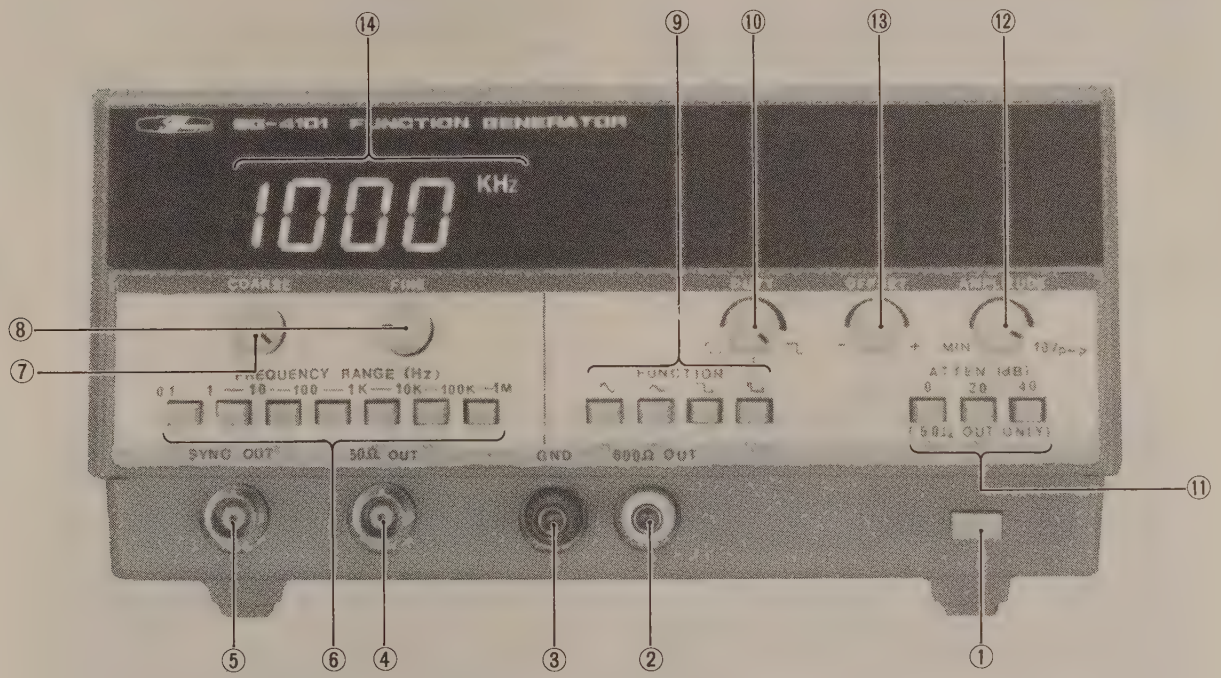
- Max. ±5V into 50Ω and 600Ω
- Max. ±10V into an open circuit

⑭ LED DISPLAY

The oscilating frequency of each function is displayed on LED with a zero-blanking method.

When a range switch is not set, only the values are shown to indicate that the unit is in operation. Therefore, the frequency at that time is not guaranteed.

Figure 2-1 Front Panel



2-2 REAR PANEL

⑮ FUSE AND VOLTAGE SELECTOR

Both the fuse holder and the power supply voltage selector. To select the power supply voltage, remove the fuse holder cap and then insert it into the desired voltage.

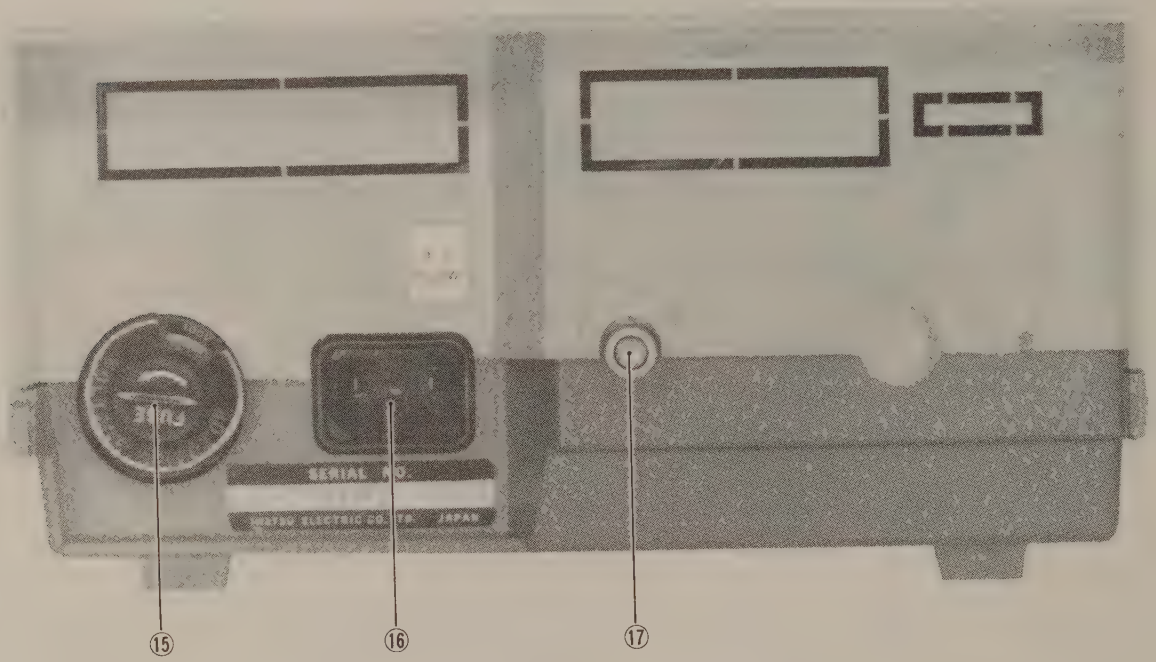
⑯ AC LINE INPUT

Connect the power cord.

⑰ ⏚ (GND)

Protective ground terminal.

Figure 2-2 Rear Panel



2.3 HOW TO USE THE CARRYING HANDLE (STAND)

The lock of the carrying handle is released by pulling both ends of it outward, allows turning of the handle approximately every 20 degree.

When fixed at the bottom of the instrument, the handle serves as the stand.

When this carrying handle is not used as the stand or the instrucment rear side via the bottom and store the handle as shown in Figure 3-5-2.

Figure 2-3-1. How to Use the Carrying Handle

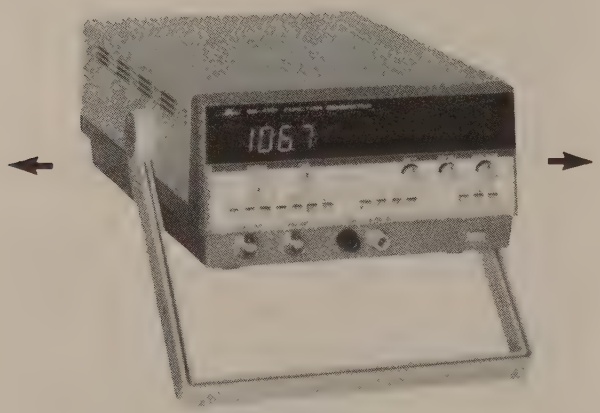
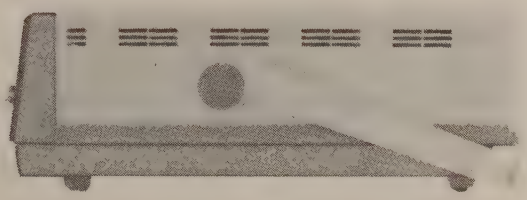


Figure 2-3-2. Storing of the Carrying Handle



emo

Section 3 Operating Information

3.1 CONNECTION OF CONNECTOR AND CABLE

50Ω OUT

When providing the signals at the 50Ω load, connect a 50Ω coaxial cable to the 50Ω OUT and also connect a 50Ω terminator to the cable end.

Under this conditions, if the 50Ω terminator is taken off, this state becomes an open circuit.

600Ω OUT

When providing the signal at the 600Ω load, connect a cable to the 600Ω OUT and also connect a 600Ω terminator to the cable end.

Under this condition, if the 600Ω terminator is taken off, this state becomes an open circuit.

SYNC OUT

When providing the signal at the 50Ω load, the square of +1V or more can be provided.

When providing the signal at the 50Ω load, connect a 50Ω coaxial cable to the SYNC OUT and also connect a 50Ω terminator to the cable end.

Also, when providing the signal at an open circuit, the square of +2V or more can be provided.

3.2 SETTING OF OSCILLATING FREQUENCY

The oscillating frequency of each function should be set as follow.

Procedure

1. Set the oscillating frequency range by FREQUENCY RANGE (Hz)
2. Adjust COARSE and FINE observing a certain number on the LED display.

The oscillating frequency overlaps each FREQUENCY RANGE (Hz) by adjustment of COARSE and FINE.

3.3 SETTING OF OUTPUT VOLTAGE

50Ω OUT

In the case of 50Ω:

The signal output can be continuously varied the range from 10 m Vp-p to Vp-p by setting AMPLITUDE and ATTEN (dB).

The signal output is 10 m Vp-p or less when setting AMPLITUDE to fully-counterclockwise and ATTEN (dB) to 40. The signal output is 10 Vp-p or more when setting AMPLITUDE to fully-counterclockwise and ATTEN (dB) to 0.

In the case of open circuit:

With the above operation, the signal outout can be continuously varied from 20 m Vp-p to 20 Vp-p.

600Ω OUT

In the case of 600Ω:

The signal output can be continuously varied 1 Vp-p to 10 Vp-p by only AMPLITUDE.

The signal output is 1 Vp-p or less when setting AMPLITUDE to fully-counterclockwise. The signal output is 10 Vp-p or more when setting to AMPLITUDE to fully-clockwise.

In the case of open circuit:

With the above operation, the signal output can be continuously varied from 2 Vp-p to 20 Vp-p.

CAUTION

The output waveform is guaranteed when setting is as follows at 50Ω load.
Output voltage: 10 Vp-p
Atten (dB): 0

3-4 SETTING OF OFFSET

Offset Voltage

The offset voltage can be continuously varied the range from –5 Vp-p to +5 Vp-p by adjusting OFFSET control.

50Ω and 600Ω
midrange: 0V
Fully-counterclockwise: –5V or less
Fully-clockwise: +5V or more

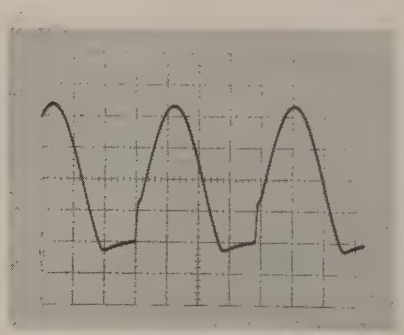
Open circuit
–10V to +10V

Guaranteed range

The signal added to offset voltage is within ±5V at 50Ω and 600Ω loads, within ±10V at opened output.

For example, when the signal output is added to offset voltage at ±5V peak (50Ω load), the output waveform is distorted as shown in Fig. 3-4.

Figure 3-4-1 Examples of Waveform Distortion I (OFFSET to Counterclockwise)



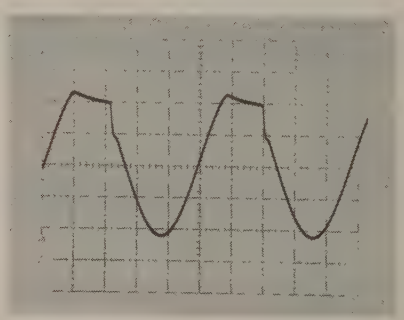
The waveform guaranteed range at 50Ω load is shown in Table 3-4.

Table 3-4 The Waveform Guaranteed Range at 50Ω load

Signal output voltage	Offset voltage
±5V peak	0V
±4V peak	Within ±1V peak
±3V peak	Within ±2V peak
±2V peak	Within ±3V peak
±1V peak	Within ±4V peak

Set the signal output voltage by AMPLITUDE.

Figure 3-4-2 Examples of Waveform Distortion II (OFFSET to Clockwise)



3-5 PULSE OUTPUT

Procedure

1. Set FUNCTION to ⊓⊔ .
2. When setting DUTY to counterclockwise, the pulse signal is provided as shown in Figure 3-5-1.
   When setting DUTY to clockwise, the pulse signal is provided as shown Figure 3-5-2.

The positive or negative pulse signal waveform is provided by the operations of AMPLITUDE and OFFSET.

The frequency can be varied by the FREQUENCY RANGE (Hz), COARSE and FINE.

3-6 DC VOLTAGE OUTPUT

The DC voltage can be provided +5V to −5V at 50Ω and 600Ω loads by setting FUNCTION to ⊓⊔ and adjusting DUTY.

Positive Voltage

Procedure

1. Set FUNCTION to ⊓⊔ .
2. Set DUTY to fully-clockwise.
3. Positive voltage (+5V to +0.5V) is provided by AMPLITUDE control.

Negative Voltage

Procedure

1. Set FUNCTION to ⊓⊔ .
2. Set DUTY to fully-counterclockwise.
3. Negative voltage (−5V to −0.5V) is provided by AMPLITUDE control.

CAUTION

- *±0V is obtained by adjustment of AMPLITUDE and OFFSET.*
- *As the oscillator is always operating even when providing DC voltage, the noise is superposed 50mV at maximum at 50Ω load.*

Figure 3-5-1 Pulse I (DUTY to Counterclockwise)

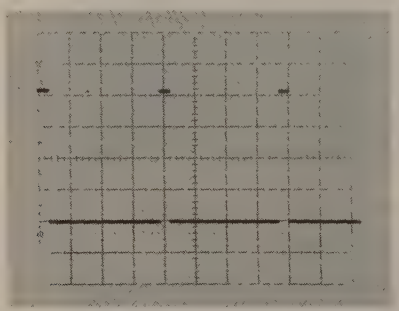
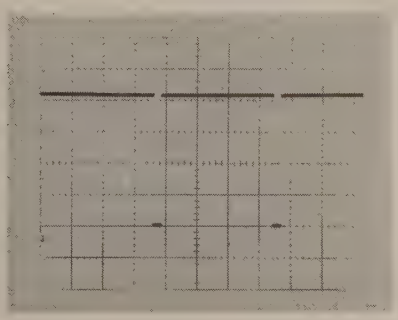


Figure 3-5-2 Pulse II (DUTY to Clockwise)



3-7 TIME RELATION BETWEEN SYNC OUT AND OUTPUT WAVEFORM

The time ralation between synchronizing output (SYNC OUT) and signal output (50Ω OUT and 600Ω OUT) is shown in Figure 3-7-1.

In the case of the sine and triangle, + slope becomes the High level and — slope becomes the Low level. A period of output waveform givesa a period of square waveform at SYNC OUT.

The square proviced the phase difference of 180°.

Figure 3-7-1 Relation Between SYNC OUT and 50Ω or 600Ω Output

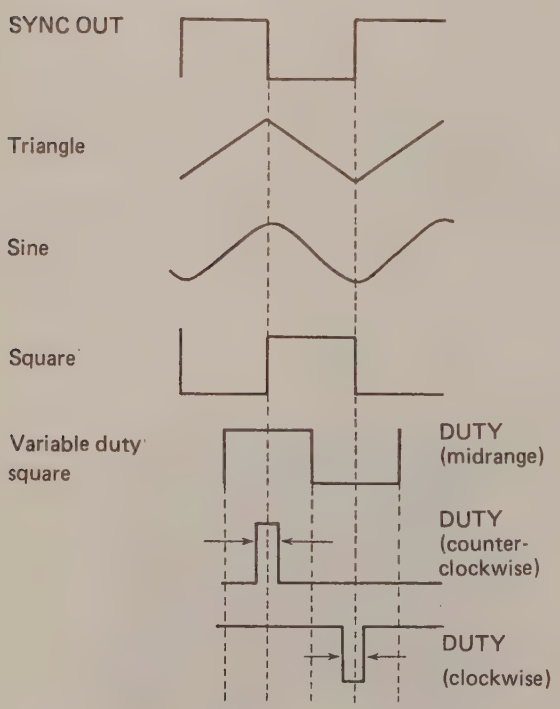
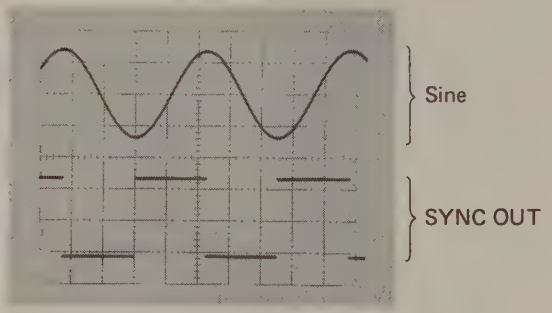
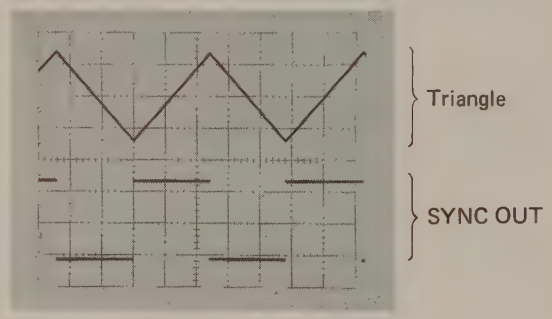


Figure 3-7-2 Example of Observation

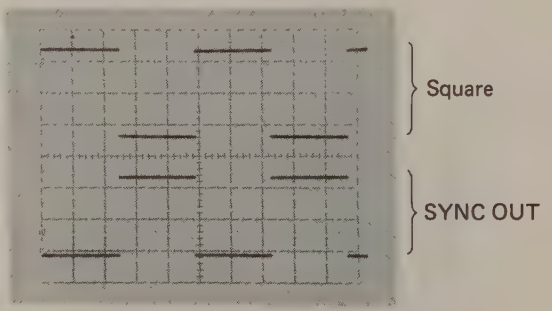
a. The SYNC OUT and sine output.



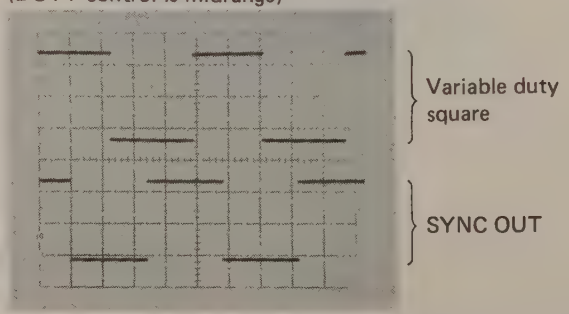
b. The SYNC OUT and triangle output.



c. The SYNC OUT and square output.



d. Variable duty square output and SYNC OUT (DUTY control is midrange)



Section 4 Schematic Diagrams

1 OVER ALL
2 VCF CIRCUIT
3 TIMING SWITCHING
4 SYNC OUT & TRIANGLE TO SINE CONVERTER
5 SQUARE WAVE GENERATOR
6 OUTPUT AMPLIFIER
7 DISPLAY CIRCUIT
8 POWER SUPPLY

P5-01 DISPLAY CIRCUIT

COARSE R701 FINE R702 DUTY R703 AMPLITUDE R704 OFFSET R706 R705

+5V GND -5V 5V POWER SUPPLY

VCO Hz KHz DP2 DP3 DP4 +12V GND -12V

J101 P101 J401 P401

P10
GL-2030C-10

C25 C26

PC11
S-I 7221#9

POWER ON SLOW 1A F11

4 GREEN 240V 5
3 YELLOW 220V 4
2 ORANGE 120V 3
1 RED 100V 2
BROWN 0V 1

S11
SDGA3P-B

GREEN AND YELLOW (SHIELED) 14

J10

T11 J11 P11

6 BLUE 1
13.7V
BLUE 2

7 8 3
PURPLE
14.7V
PURPLE 4

9 10 5
GRAY
22.0V
GRAY 6

11 12 7
WHITE
22.7V
WHITE 8
13

POWER SUPPLY
VCF CIRCUIT
TIMING SWITCH
SINC OUT & TRIANGLE TO SINE
SQUARE WAVE GEN.
OUTPUT AMP.

PB-01 POWER & GEN. CIRCUIT

P12 J12 J13 J14 J15 J16

Q11 Q13 Q15 Q17

J701 SYNC OUT

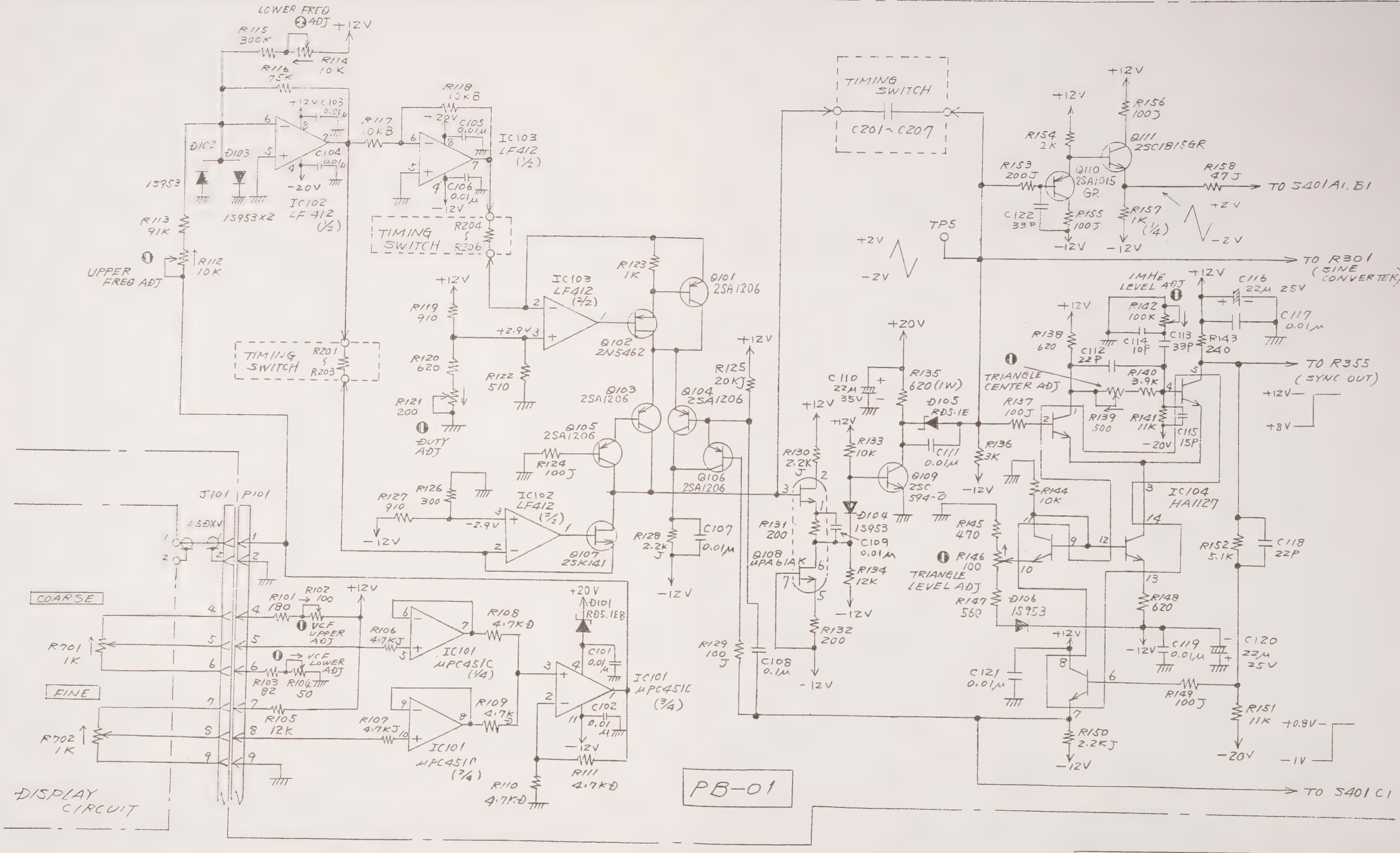
TL701 TL702 600Ω OUT

J702 50Ω OUT

POWER TRANS MOUNTING BOARD

SG-4101
OVER ALL 1

BBW SG41010108 1



SG-4101 VCF CIRCUIT	2
BBWSG20002106	1

FROM IC 102 (1/2) #7

FROM IC 103 (1/2) #7

FREQUENCY RANGE Hz

S 101

0.1 / 1 / 10 / 100 / 1K / 10K / 100K / 1M

A1 B1 C1 D1 E1 F1 G1

A2 B2 C2 D2 E2 F2 G2

A3 B3 C3 D3 E3 F3 G3

A4 B4 C4 D4 E4 F4 G4

A5 B5 C5 D5 E5 F5 G5

A6 B6 C6 D6 E6 F6 G6

C201 1M

C202 0.01M

C205 20P

C203 82P

C206 20P

C204 82P

C207 100P

R201 10KB (CRB25)

R202 100K B (CRB25)

R203 1MΩ (CFB)

R204 5KB (CFA)

R205 50K B (CFA)

R206 500KΩ

FROM IC 102 (3/2) #2

FROM IC 103 (2/2) #2

FROM Q108 (GATE) (#3)

FROM D105 (ANODE) (TP5)

TO DISPLAY CIRCUIT

HZ 11 → 11 → #3

KHz 12 → 12 → #4

DP2 13 → 13 → #5

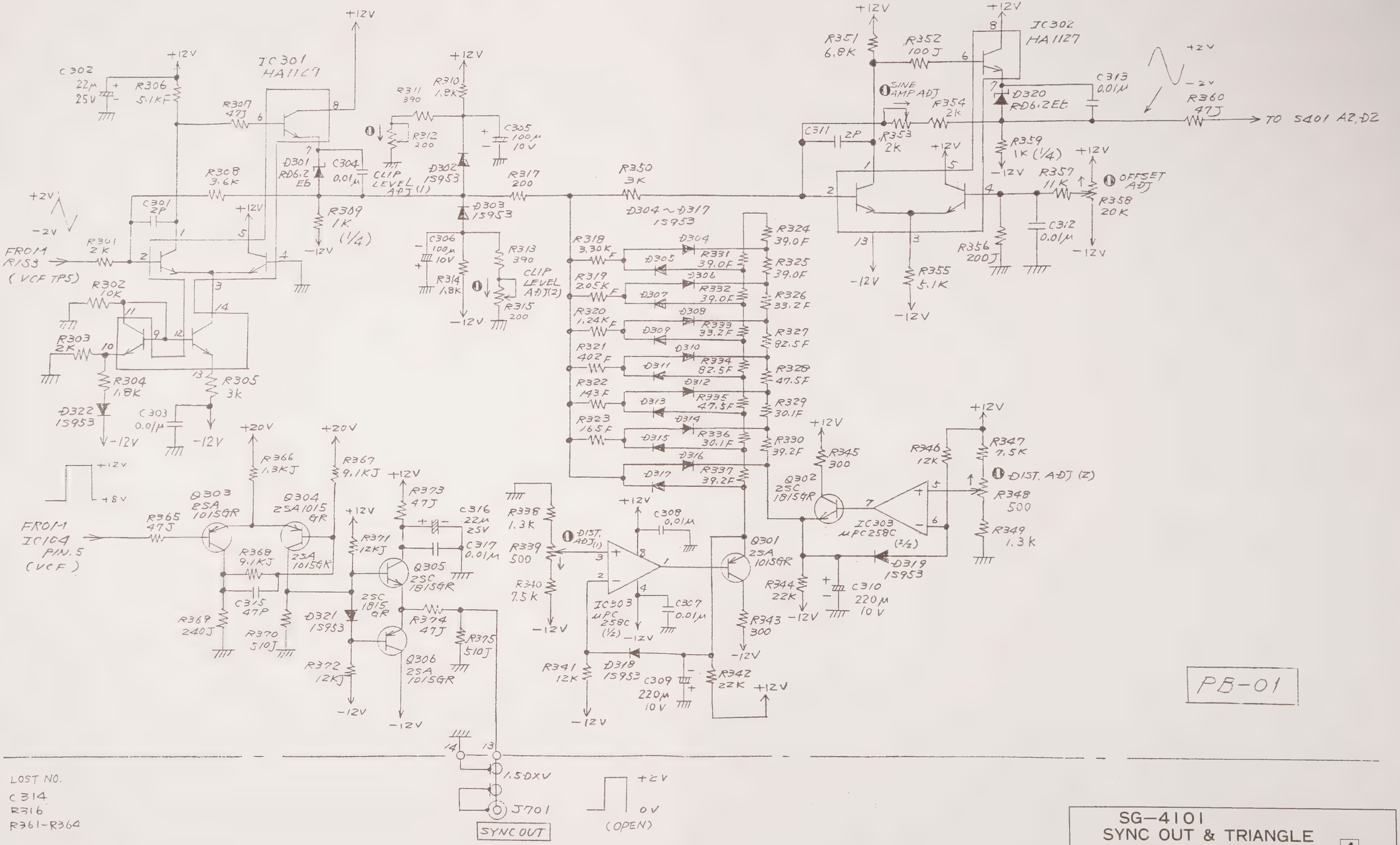
DP3 14 → 14 → #6

DP4 15 → 15 → #7

P101 J101

PB-01

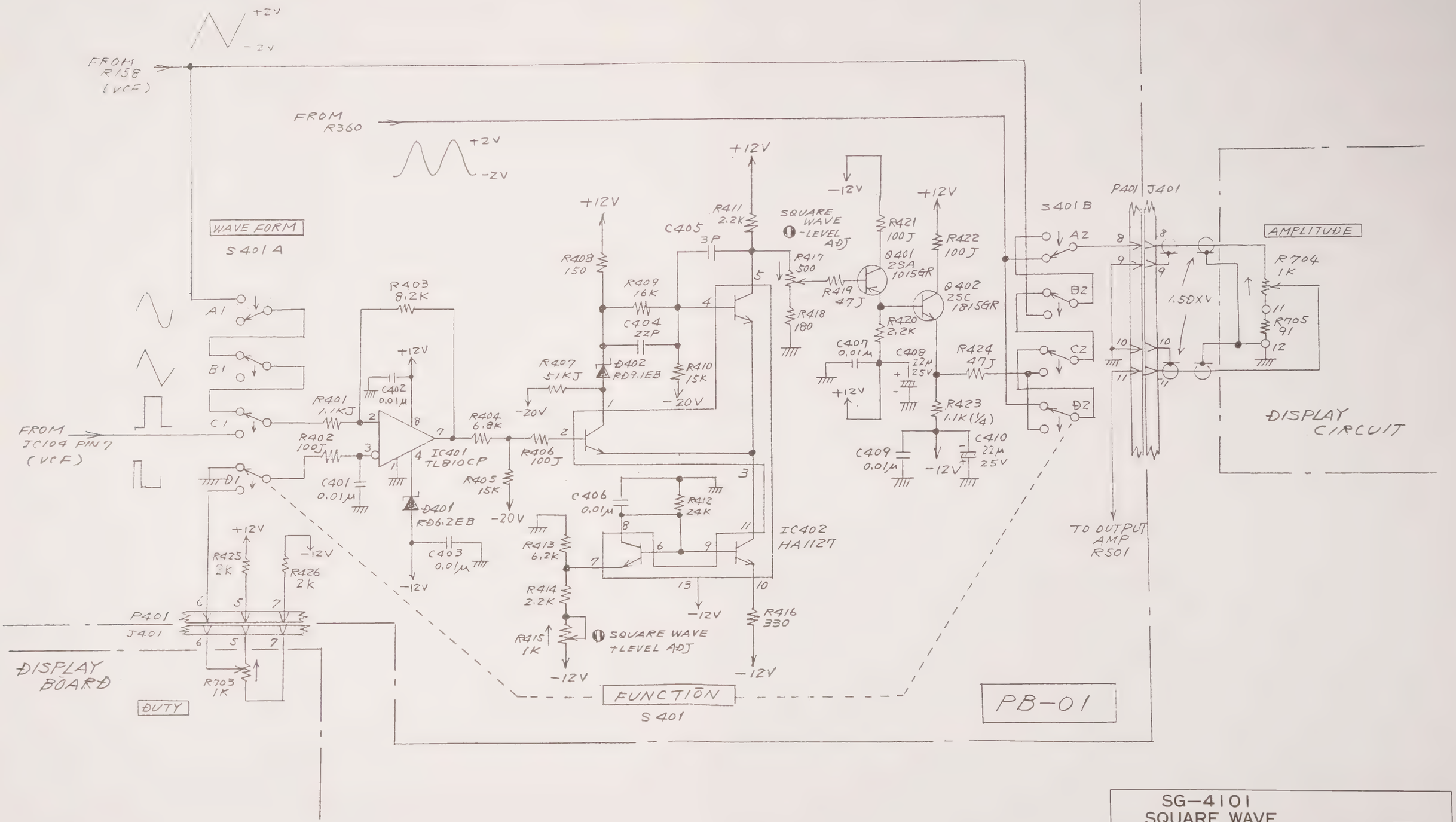
SG-4101 TIMING SWITCH 3	
BBWSG20002107	1



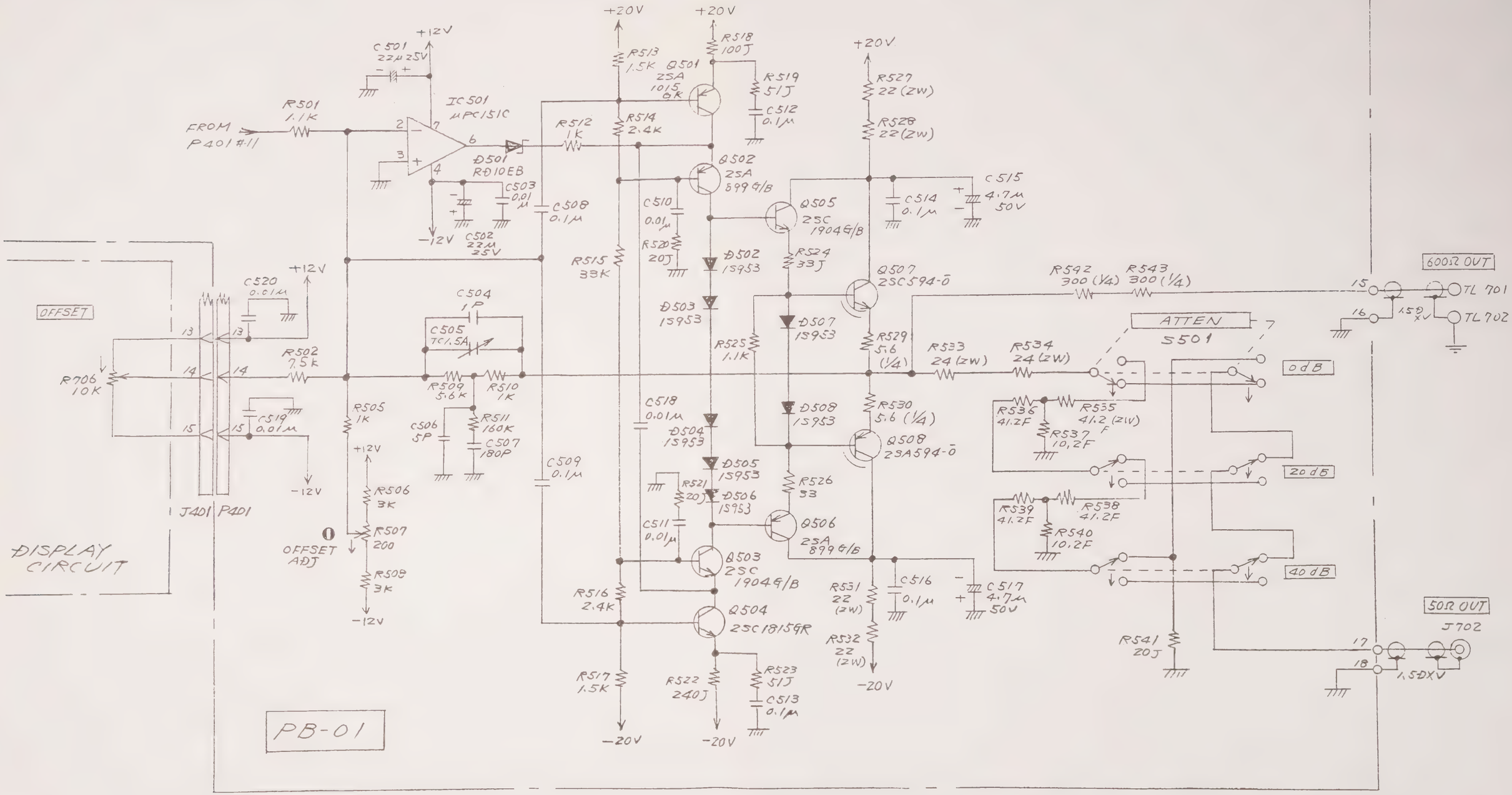
PB-01

LOST NO.
C314
R316
R361-R364

SG-4101 SYNC OUT & TRIANGLE TO SINE CONVERTER	4
BBWSG20002108	1

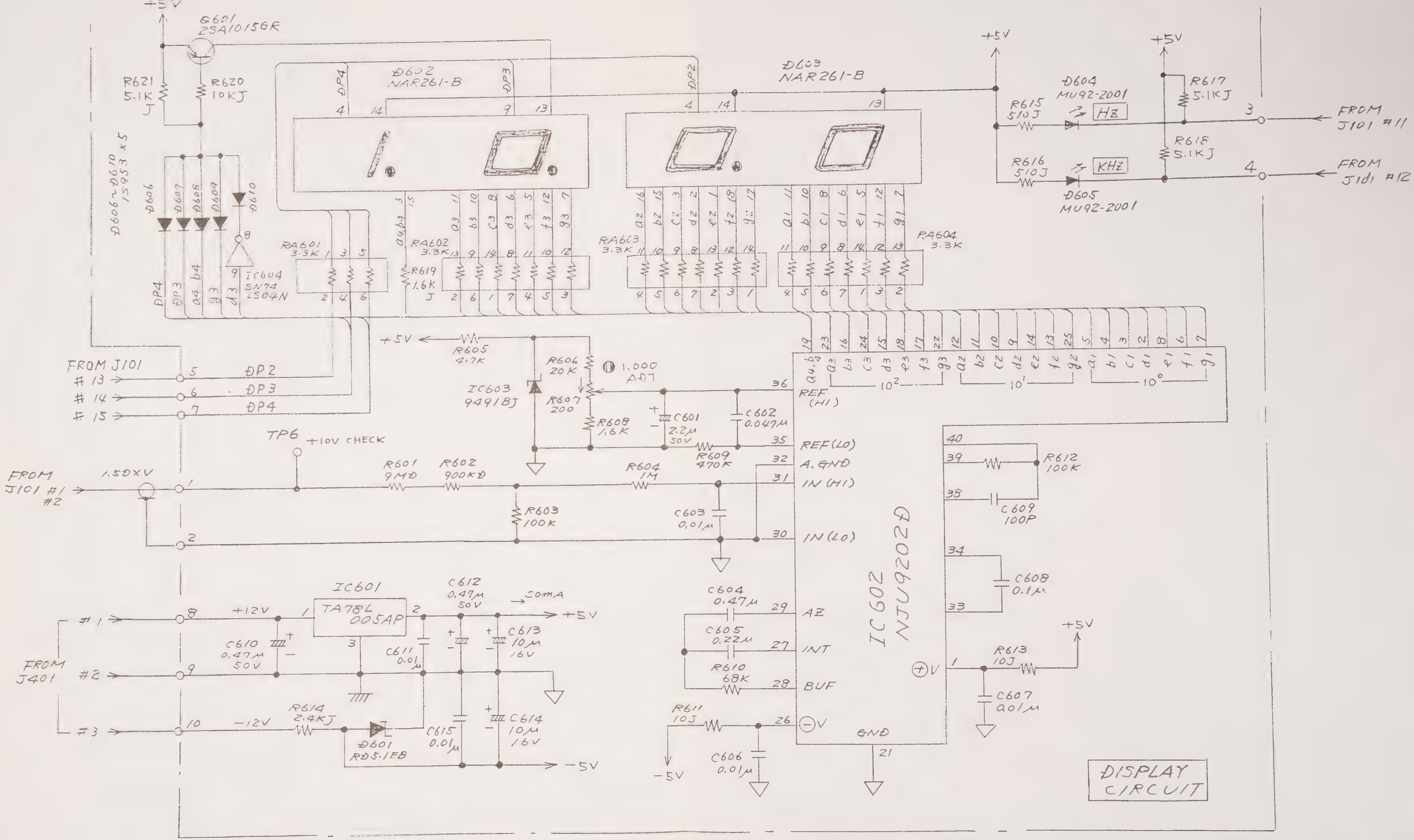


SG-4101 SQUARE WAVE GENERATOR 5	
BBWSG20002109	1

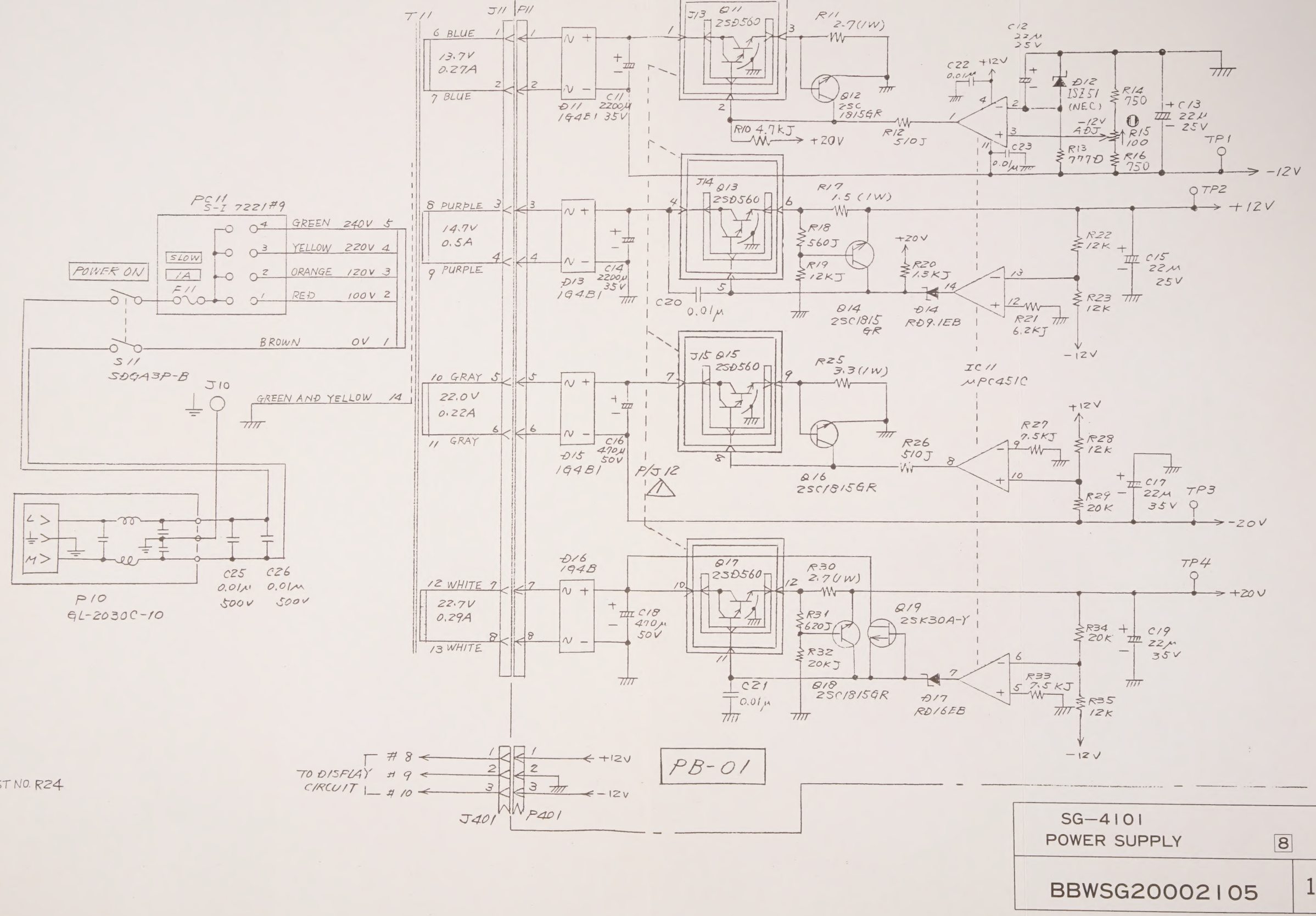


LOST No.
R503,
R504

SG—4101 OUTPUT AMPLIFIER 6	
BBWSG20002110	1



SG-4101 DISPLAY CIRCUIT 7	
BBWSG20002111	1



LOST NO. R24

SG-4101 POWER SUPPLY	8
BBWSG20002105	1

34793

IWATSU ELECTRIC CO., LTD.